Earth's Atmosphere
ES-4 The student will demonstrate an understanding of the dynamics of Earth's atmosphere.

ES-4.4 Attribute global climate patterns to geographic influences (including latitude, topography, elevation, and proximity to water).
Taxonomy level: 4.3-B Analyze Conceptual Knowledge

Previous/future knowledge: Students have not been introduced to the concepts in this indicator in any previous grade.

It is essential for students to know that climate is referred to as the average weather conditions of a region, the weather patterns that occur over many years. Scientists usually describe it in terms of the average monthly and yearly temperatures, or temperature range, and the average amount of precipitation.
Other factors also influence the temperature and precipitation of a climate region:

Latitude A major influence on the climate of a region is its distance from the equator – *latitude*. Latitude determines the amount of solar energy received by, and the prevailing wind belts of, the region. Climate zones based on latitude include tropical climates, middle-latitude climates, and polar climates.

Topography & Elevation The shape of the land, *topography*, also influences climate. Mountains influence the temperature and moisture content of air masses. Ascending air or descending air on mountain slopes causes differences in temperature and precipitation on the windward and leeward sides of the mountain. Since temperatures usually decrease with altitude, higher elevation climates are usually cooler that sea level climates.

Proximity to Water Water heats up and cools down more slowly than land. Thus, large bodies of water affect the climates of coastal areas. Many coastal regions are warmer in the winter and cooler in the summer than inland areas of similar latitude.

It is not essential for students to know the details for classification each particular climate region based on latitude or on the Koppen classification system based on distribution of vegetation.

Assessment Guidelines:
The objective of this indicator is to *attribute* global climate patterns to geographic influences, therefore, the primary focus of assessment should be to determine from presented material the geographic influence that relates to the particular climate pattern.
In addition to *attribute* appropriate assessments may require students to:

- *summarize* the major points about how each factor influences climate;
- *compare* the climate in a coastal region with one inland or a climate on the windward side of a mountain with one on the leeward side of the mountain; or
- *recall* the main factors used to identify a climate.